CLAIMS

1. A light emitting device comprising:

a light guide having an elongate transparent core surrounded by an optically transmitting sheath;

one or more light sources coupled to a first end of said light guide; and

transparent diffuser particles distributed within the core to scatter light in a substantially forward direction from the first end of said core toward a second end of said core;

wherein the diffuser particles have a refractive index close to that of the core, low back reflectance and low absorbance.

2. The light emitting device of claim 1 wherein light emitted from the second end of the core has colour variation imperceptible to the human eye and small and gradual variations in intensity.

3. The light emitting device of claim 2 wherein a concentration of the diffuser particles in the core and a length of the light guide are varied to achieve the colour variations imperceptible to a human eye and the small and gradual variations in intensity in said emitted light.

4. The light emitting device of claim 1 wherein the optically transmitting sheath has a lower refractive index than the core.

5. The light emitting device of claim 1 wherein the ratio of the refractive index of the diffuser particles to the refractive index of the core equals $1 + \mu$, and μ has low variance over a wavelength range of said one or more light sources.

6. The light emitting device of claim 5 wherein $|\mu| < 0.035$ at the average wavelength of said one or more light sources.

7. The light emitting device of claim 5 wherein $\mu = 0.018$ at a wavelength of 589nm.

8. The light emitting device of claim 5 wherein $\mu = 0.011$ at a wavelength of 589nm.

9. The light emitting device of claim 1 wherein the diffuser particles yield a high ratio of light that is forward transmitted with small angular deviation to back reflected light.

10. The light emitting device of claim 1 wherein a concentration of the diffuser particles in the core varies along a length of the core.

11. The light emitting device of claim 1 wherein said light guide comprises an axial diffuser particle number in the range of about 6 – 300.

12. The light emitting device of claim 1 wherein said light guide comprises an axial diffuser particle number in the range of about 6 – 50.

13. The light emitting device of claim 1 wherein said light guide comprises an axial diffuser particle number in the range of about 50 – 300.

14. The light emitting device of claim 8 wherein said axial diffuser particle number is in the range of about 20 – 40.

15. The light emitting device of claim 1 wherein the diffuser particles have a size substantially greater than a wavelength of said one or more light sources.

16. The light emitting device of claim 1 wherein said one or more light sources are selected from: LEDs, incandescent sources, discharge lamps, lasers, or other high brightness sources.

17. The light emitting device of claim 1 further comprising control means for controlling the output of said one or more light sources across a range of wavelengths.

18. The light emitting device of claim 15 wherein said light sources are in the form of an LED array.

19. The light emitting device of claim 15 wherein said light sources are in the form of an LED array emitting red, green and blue light.

20. The light emitting device of claim 1 further comprising control means for controlling the output of said one or more light sources across a range of wavelengths, said one or more light sources being an LED array wherein the relative outputs of said LEDs are adjusted via said control means such that said light emitted from said second end of said core is tunable across a wavelength range of said one or more light sources.

21. The light emitting device of claim 1 comprising at least two light sources, each said light source emitting light having a characteristic angular distribution function, wherein the angular distribution functions of all light sources are similar.

22. The light emitting device of claim 21 wherein the angular distribution functions of all light sources are the same.

23. The light emitting device of claim 1 further comprising a coaxial reflector surrounding said light guide to reflect light escaping from said core back through said core towards the second end of said core, said reflected light increasing the luminous output of said light guide.

24. The light emitting device of claim 1 wherein the core is a polymer.

25. The light emitting device of claim 1 wherein the core is glass.

26. The light emitting device of claim 1 wherein the sheath is a cladding of low refractive index polymer.

27. The light emitting device of claim 26 wherein the polymer is a fluoro-polymer.

28. The light emitting device of claim 1 wherein the sheath is a cladding of aerogel or low refractive index glass.

29. The light emitting device of claim 1 wherein the sheath is selected from: a layer of water; a low refractive index liquid; air; other gas; or vacuum.

30. The light emitting device of claim 1 wherein the sheath is transparent.

31. The light emitting device of claim 1 wherein the sheath is translucent.

32. The light emitting device of claim 1 wherein the diffuser particles are made from a polymer.

33. The light emitting device of claim 32 wherein the diffuser particles are in the form of particles that are not dissolved by a monomeric mixture used to produce the polymer core

34. The light emitting device of claim 32 wherein the diffuser particles are a cross-linked polymer, such as PMMA or polystyrene.

35. The light emitting device of claim 24 wherein the polymer core is formed by extrusion or injection moulding.

36. The light emitting device of claim 24 wherein the polymer core is formed by extrusion or injection moulding from uncross-linked PMMA and the diffuser particles are formed of cross-linked PMMA.

37. The light emitting device of claim 1 wherein the diffuser particles are made from transparent non-polymeric materials, such as glass.

38. The light emitting device of claim 1 wherein the diffuser particles are spherical.

39. The light emitting device of claim 1 wherein the diffuser particles are selected from one of: cylindrical; polyhedral; ellipsoidal; or asymmetrical in shape.

40. The light emitting device of claim 1 wherein the diffuser particles have a size in the range 5μm to 50μm.

41. The light emitting device of claim 1 wherein the diffuser particles have a size in the range 25μm to 35μm.

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